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An Examination of the Seeds of some Native Orchids.

By Carlton C. Curtiss.

(Plates CL.–CLII.)

During the past year some research has been made, at the suggestion of Dr. Britton, on the seeds of the North American Orchids to determine their structure and to note what additional characters of classification and relationship the seeds themselves might afford.

The seeds are membranous, rather elongated capsules, loosely embracing an elliptical, ovate or pyriform nucellus. In organization they indicate a low type of flowering plant. The nucellus is composed of a large number of polyhedral cells, which are filled with a granular, amber-colored mass, imbedded in which is a great abundance of oily matter. The embryo is exalbuminous, and no cotyledon and radicle are formed. The Orchid seeds, therefore, are of interest as furnishing an example of the arrested stage of embryonic development. With germination the cells of the nucellus divide, and eventually form tuber-like buds that ultimately give rise to the plant. In this peculiarity the Orchid resembles many saprophytes. Especially in the structure and outward appearance of its seed does it closely resemble those of several Ericaceæ, particularly *Monotropa*. The nucellus is generally an excellent illustration of the geometrical arrangement of cells in vegetable growth. Two or more confocal periclines are associated with a usually larger number of orthogonal hyperbolic trajectories. See *Pogonia ophioglossoides* (and fig. 17, Plate CLI.).

Surrounding the nucellus is the integument. Before fertilization it presents the usual form as seen in the ovules of other plants, but after fertilization it develops rapidly, assuming an inflated sac-like form, and in the majority of species greatly exceeds the nucellus in its growth. The seeds are anatropous and sessile; and when removed from the placenta the location of the hilum is marked by an opening. This is caused by the shrinking or, possibly, by the partial absorption of the chalaza, remains of which may still be seen in the ripened seed. This leaves the integument alone connected with the placenta. The free ends, therefore, lend to the seeds the appearance of an arillus, the opening at what seems to be the apex being due to the bending in of the cells of the inflated integument as they approach the hilum. The testa is the conspicuous feature of the seed, and with the embryo furnishes one of the family features or distinguishing characters of the order. It is composed of cells of varying forms, as seen in the plates. The outer margins of the cell wall are much thickened. Thus the testa presents in its outward aspect a ribbed surface, and gives to the seed a cage-like appearance. In *Pogonia ophioglossoides* the so-called ribs (thickenings) do not correspond to the cell divisions, but form long bands over the length of the testa, branching and running together somewhat at either extremity, (fig. 19, Plate CLII.). The sides of the cells, as well as all the other margins, are extremely delicate and colorless. The inner face of the cell often receives an elegant sculpturing from delicate bands that are quite characteristic of the several species in which they occur. These lines are noticeably stronger towards the base of the testa in some species, quite fading out at the apex. This faulty development of the nucellus together with the delicacy of the seed coat is doubtless the cause of the relative scarcity of Orchids. Remembering the large number of pods usually produced by each plant and that each pod contains something like six thousand seeds, we realize the enormous fatality among the seeds. This is not in any way connected with a lack of fertilization. The classical work of Darwin has demonstrated the completeness of this process, were it necessary to go back to the flower to ascertain the fact. The whole appearance of the seed is that of a waif, poorly developed and insufficiently

protected to retain its vitality, in the extremes of our climate. It would appear that the seed is not in surroundings congenial to its nature, and has not yet been able to adapt itself to its environment. This also doubtless explains the paucity of species found in the Northern United States. The seeds are beautiful objects under the microscope. Elegant in outline their beauty is enhanced by the graceful curves of the cell-margins, which often wind into fantastic figures, or build up the testa with cells of mathematical exactness. The clearness of the cell wall in some species (*Listera cordata*) reminds one of the valves of a diatom, while a study of the delicate markings on the inner surface of the cell, tax not a little the patience and skill of the microscopist.

I have been greatly interested in the examination of specimens of the so-called Vanilla Bean, gathered in various parts of the world. The value of these pods varies greatly, dependent upon the locality in which they grow. So close is their resemblance, however, that the merchants have great difficulty in distinguishing them. The testa is very thick and strong. Instead of a ribbed surface the whole outer wall, save a slit-like central portion, is evenly thickened and forms a heavy plate. Save in this particular and their dark reddish brown color, the seeds are identical in structure with those of our native orchids. The resemblance of the eight specimens examined is very close. With perhaps two exceptions, the seeds would appear to belong to the same species. In the other specimens some variations were noticeable, probably due to climate. The constancy of these features as a basis of distinguishing them would necessitate a wider comparison than I have been able to make.

In examining the seeds of our Eastern orchids examples were chosen in each case that as far as possible would be typical of the species. The estimates are made upon normally developed seeds, which were not distorted by luxuriant growth or dwarfed by untoward circumstances. I believe that a wider study of the forms will make no material change in the data presented. In all possible cases comparison of fruit from widely separate localities has been made, and with rare occurrence has marked variation of the seed been manifest. Occasionally the sculpturing of the cell-wall changes, and often the variation of the cell dimensions is consid-

erable, so that the values given in the measurements of the cells, which are the averages of the cells taken from base to apex of about twenty specimens in every case, cannot be found applicable to all cases, but I trust that the proportion which these figures form will be found to be very constant. Such has been the experience in all cases examined. Furthermore, it should be said that having selected as carefully as possible a seed that illustrated most fully the characters of its species, it was drawn as it actually existed. No attempt has been made to introduce into the drawings the salient points of the species that were not already present. So that while some features may not be well brought out I judge that this course will result in a truer representation of the seeds and in less liability to error.

Looking at the seeds as a whole, a unity of form, structure, and organization appear as constant features of family relationship. A comparison of the seeds, however, reveals wide variation and establishes relationship as told by the seeds themselves widely differing from that of the Manuals of Botany. In some instances the relative positions of genera remained unchanged. More often not only does a misplacement of genera seem manifest, but a total disarrangement of tribal relations results. By a comparison of the figures and their explanations the natural relationship of the species as based upon the seed characters at once becomes apparent. Two extreme types are manifest; the one characterized by its elongated tapering testa and elongated cells. Of this *Tipularia* is the type, to which stand related more or less closely, as is shown by the plates, *Aplectrum* and *Calypso*, *Gyrostachys* and *Peramium*, *Cypripedium*, *Pogonia* and *Orchis*. The opposing type is characterized by obovoid or inflated testæ and shorter cells often equilateral. Of this *Corallorhiza* or *Hexalectris* may be taken as the type, and as related would appear *Listera*, *Achroanthes* and *Liparis*, *Habenaria*, *Arethusa* and *Epipactis* and *Limodorum*.

The genera have been taken up in the sequence followed in the Sixth Edition of Dr. Asa Gray's Manual of Botany, of the Northern United States.

1. ACHROANTHES, Raf.

Achroanthes unifolia (Michx.) Raf. (*Microstylis ophioglossoides*, Nutt.) Testa obovoid, about twice as long as thick, averaging

0.343 × 0.19 mm. Cells irregularly polygonal, becoming longer and narrower toward the summit, about twice as long as wide, averaging 0.047 × 0.022 mm. (Plate CL., figs. 1, 1a.)

2. LIPARIS, Richard.

Liparis liliifolia (L.) Richard. Testa oblong, slightly narrowed at base, about three times as long as thick, averaging 0.35 × 0.12 mm. Cells regular, oblong, about three times as long as wide, averaging 0.05 × 0.017 mm. (Plate CL., fig. 2.)

3. CALYPSO, Salisb.

Calypso bulbosa (L.) Reichenb. (*Calypso borealis*, Salisb.) Testa oblong, tapering towards apex, about five times as long as thick, averaging 0.59 × 0.125 mm. Cells regular, oblong, averaging 0.085 × 0.025 mm., thus over three times as long as broad. Inner cell wall finely reticulated. (Plate CL., figs. 3, 3 a.)

4. TIPULARIA, Nutt.

Tipularia unifolia (Muhl.) B. S. P. (*Tipularia discolor*, Nutt.) Testa oblong, acute, about four and a half times as long as thick, averaging 0.534 × 0.121 mm. Cells regular, oblong, about ten times as long as wide, averaging 0.15 × 0.015 mm. Inner cell wall closely, at times loosely reticulated. (Plate CL., figs. 4, 4 a.)

5. APLECTRUM, Nutt.

Aplectrum spicatum (Walt.) B. S. P. (*Aplectrum hiemale*, Nutt.) Testa fusiform, about nine times as long as thick, averaging 1.36 × 0.153 mm. Cells irregularly oblong, about eight times as long as wide, averaging 0.125 × 0.0168 mm. Inner cell wall banded with delicate parallel or branching lines. (Plate CL., figs. 5, 5 a.)

6. CORALLORHIZA, Haller.

Corallorhiza innata, R. Br. Testa obovoid, about twice as long as thick, averaging 0.48 × 0.23 mm. Cells oblong, becoming polygonal at the apex, about twice as long as wide, averaging 0.069 × 0.037 mm. Inner cell-walls sparsely banded, lines very irregular and obscure. (Plate CL., figs. 6, 6a.)

Corallorhiza multiflora, Nutt. Testa oblong-obovoid, about five times as long as thick, averaging 0.70 × 0.172 mm. Cells longer and narrower than in innata, about three times as long as wide, averaging 0.065 × 0.021 mm. Inner cell-wall banded with parallel sometimes anastomosing or branching lines. (Plate CL., figs. 7, 7a.)

7. HEXALECTRIS, Raf.

Hexalectris aphyllus, Raf. Testa elliptical, obtuse, about twice as long as thick, averaging 0.485 × 0.221 mm. Cells elongated, becoming polygonal towards apex, about three times as long as wide, averaging 0.065 × 0.0196 mm. Inner cell wall marked by excessively branching lines. (Plate CLI., figs. 8, 8a.)

7A. BLETIA, R. P.

Bletia verecunda, Sw. Testa obovoid, about one and a half times as long as thick, averaging 0.231 × 0.171 mm. Cells polygonal, about one and a half times as long as broad, averaging 0.061 × 0.041 mm. Added for comparison with *Hexalectris*. (Plate CLI., fig. 9.)

8. LISTERA, R. Br.

Listera cordata (L.) R. Br. Testa oblong-fusiform, about three and one-half times as long as thick, averaging 0.845 × 0.25 mm. Cells square or polygonal, about one and a half times as long as wide, averaging 0.032 × 0.025 mm. (Plate CLI., fig. 10.)

Listera australis, Lindl. Testa subrotund, about one and a half times as long as thick, averaging 0.362 × 0.20 mm. Cells polygonal, rather longer than broad, averaging 0.036 × 0.028 mm. (Plate CLI., fig. 11.)

Listera convallarioides (Sw.) Nutt. Testa obovoid, about twice as long as thick, averaging 0.412 × 0.207 mm. Cells polygonal, somewhat longer than broad, averaging 0.034 × 0.026 mm. (Plate CLI., fig. 12.)

9. GYROSTACHYS, Persoon.

Gyrostachys cernua (L.) Kuntze. (*Spiranthes cernua*, Richard.) Testa oblong, contracted towards apex, over four times longer than thick, averaging 0.541 × 0.112 mm. Cells regular, oblong, shorter towards apex, about seven times longer than wide, averaging 0.132 × 0.019 mm. Inner cell wall marked by delicate, parallel, subdistant lines. (Plate CLI., figs. 13, 13a.)

10. PERAMIUM, Salisbury.

Peramium repens (L.) Salisb. (*Goodyera repens*, R. Br.). Testa elongated, slightly fusiform, about seven times longer than thick, averaging 0.877 × 0.123 mm. Cells square to oblong, somewhat irregular, about three times longer than broad, averaging 0.052 × 0.019 mm. (Plate CLI., fig. 14.)

Peramium pubescens (L.) (*Goodyera pubescens*, R. Br.). Testa elongated, tapering towards apex, about ten times longer than thick, averaging 0.91 × 0.084 mm. Cells regular, elongated, about eight and a half times longer than broad, averaging 0.121 × 0.014 mm. (Plate CLI., fig. 15.)

11. Epipactis, Hoff.

Epipactis viridiflora (Hoff.) Reich. (*E. Helleborine*, var. *viridens*, A. Gray). Testa elongated, somewhat fusiform, about five times longer than thick, averaging 1.31 × 0.261 mm. Cells polygonal, becoming hexagonal towards base, about twice as long as broad, averaging 0.048 × 0.018 mm. (Plate CLI., figs. 16 and 16a.)

12. Arethusa, L.

Arethusa bulbosa, L. Testa oblong, less than twice as long as thick, averaging 0.45 × 0.243 mm. Cells oblong to square, smaller towards base, over twice as long as wide, averaging 0.0425 × 0.0171 mm. (Plates CLI. CLII., figs. 17a and 17.)

13. Limodorum, L.

Limodorum tuberosum, L. (*Calopogon pulchellus*, R. Br.) Testa oblong, tapering at apex and base, about three times as long as thick, averaging 0.723 × 0.207 mm. Cells regular, oblong, about two and a half times as long as wide, averaging 0.033 × 0.014 mm. (Plate CLII., fig. 18.)

14. Pogonia, Juss.

Pogonia ophioglossoides (L.) Ker. Testa oblong, tapering at apex, ribbed by longitudinal bands that branch at base and apex, about seven times as long as thick, averaging 1.23 × 0.183 mm. Cells oblong, hexagonal, about three times longer than wide, averaging 0.0946 × 0.0298 mm. Inner cell wall banded by delicate lines that usually fade out above nucellus. (Plate CLII., figs. 19, 19 a.)

Pogonia trianthophorus (Sw.) B. S. P. (*Pogonia pendula*, Lindl.) Testa oblong, about as long as thick, averaging 0.570 × 0.197 mm. Cells oblong or polygonal, about two and a half times longer than wide, averaging 0.0525 × 0.0226 mm. Inner cell wall banded with branching, irregular, sub-distant lines. A variable form, sometimes longer and narrower, or with inflated summit and contracted base, having little in common with the seeds of the species of Eupogonia. (Plate CLII., figs. 20, 20 a.)

Pogonia verticillata (Willd.) Nutt. Testa oblong, about six times longer than thick, averaging 1.16 × 0.176 mm. Cells oblong, about five times longer than broad, averaging 0.110 × 0.0236 mm. (Plate CLII., fig. 21.)

Pogonia affinis, Austin. Testa oblong, about six and a half times longer than thick, averaging 1.183 × 0.170 mm. Cells oblong, about five times longer than broad, averaging 0.117 × 0.0255 mm. (Plate CLII., fig. 22.)

15. Orchis, L.

Orchis spectabilis, L. Testa oblong, slightly tapering at ends, about four and a half times longer than thick, averaging 0.57 × 0.12 mm. Cells regular, oblong, about five times longer than wide, averaging 0.117 × 0.022 mm. (Plate CLII., fig. 23.)

16. Habenaria, Willd.

Habenaria ciliaris (L.) R. Br. Testa oblong, about two and a half times as long as thick, averaging 0.452 × 0.18 mm. Cells oblong or polyhedral, about three times longer than wide, averaging 0.0496 × 0.0157 mm. (Plate CLII., fig. 24.)

17. Cypripedium, L.

Cypripedium pubescens, Willd. Testa elongated-fusiform, about five times as long as thick, averaging 1.35 × 0.25 mm. Cells oblong, about five times longer than wide, averaging 0.14 × 0.023 mm. (Plate CLII., figs. 25, 25a.)

In determining species the seeds are not an uncertain element. While it would not be possible to take any one seed, and from it alone locate its position, not a collection of seeds from any fruit has failed to indicate such pronounced individual characters as to render a confusion of species possible. Consider, for example, such troublesome species as *Peramium repens* and *P. pubescens*. While the generic features are pronounced in all the seeds, in each species is apparent certain individual characters that sharply separate them. The more graceful proportions and nicer fitting of cells, together with their elongation and narrowness, easily distinguish *Peramium pubescens*. In *Peramium repens* the cells are shorter, often quite equilateral and intercellular spaces abound. In the species of *Listera* examined the same specific differences exist. In *Listera cordata* is noted a decided departure from *Listera*

australis and *L. convallarioides* in its elongated testa and the squareness of its cells. The relationship of *Listera convallarioides* and *L. australis* is altogether too close. Of *Listera australis* but indifferent specimens were procurable, and the figure may not be typical. It is separated from *convallarioides* by a longer cell and less rotund testa, and the seed indicates that it is in closer relation with *L. cordata* than is *L. convallarioides*.

It may be worthy of note that the seeds often appeared as indicative of the character or disposition of the plant. In the case of *Peramium* the seeds of the two species examined did not always show constant and pronounced features, and there was an obvious tendency to variation, and assumption of characters common to both.

In *Pogonia* the reverse is to be noted. By reference to the figures it will be seen how strongly the individual features of each species are manifested. These pronounced characters indicate a decided bent in the plant life that has made a sharp demarkation of species. And we would expect to find the species widely separated and rigidly fixed, as is the fact. In the case of *Pogonia affinis* and *Pogonia verticillata* no noteworthy difference exists. The form of seed, character of cell, wall and nucellus are identical. It is to be seriously doubted if any tangible distinction can be maintained between these two species. Furthermore such is the disposition of the genus that we would expect pronounced features to characterize the species. It should be said that but one specimen, and that an excellent one, was examined. I would consider it a favor to receive mature fruit of this plant.

In examining these seeds one fact came out very clearly, i. e. the importance of the fruit as one of the prime factors of classification. This would naturally be the case, for the fruit is the consummation of the plant life. In the nucellus rests the occult power to produce its kind; here also is lodged the impetus to change and variation. Climate and soil and cultivation may assist the plant in its departure from the parent type, but that restlessness which renders the classification of some genera so difficult, is due more to the hidden force lodged by the plant in the nucellus than all other combined influences. It seems reasonable, therefore, that something of this inherent disposition of the plant that is to

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australis and *L. convallarioides* in its elongated testa and the squareness of its cells. The relationship of *Listera convallarioides* and *L. australis* is altogether too close. Of *Listera australis* but indifferent specimens were procurable, and the figure may not be typical. It is separated from *convallarioides* by a longer cell and less rotund testa, and the seed indicates that it is in closer relation with *L. cordata* than is *L. convallarioides*.

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In *Pogonia* the reverse is to be noted. By reference to the figures it will be seen how strongly the individual features of each species are manifested. These pronounced characters indicate a decided bent in the plant life that has made a sharp demarkation of species. And we would expect to find the species widely separated and rigidly fixed, as is the fact. In the case of *Pogonia affinis* and *Pogonia verticillata* no noteworthy difference exists. The form of seed, character of cell, wall and nucellus are identical. It is to be seriously doubted if any tangible distinction can be maintained between these two species. Furthermore such is the disposition of the genus that we would expect pronounced features to characterize the species. It should be said that but one specimen, and that an excellent one, was examined. I would consider it a favor to receive mature fruit of this plant.

In examining these seeds one fact came out very clearly, i. e. the importance of the fruit as one of the prime factors of classification. This would naturally be the case, for the fruit is the consummation of the plant life. In the nucellus rests the occult power to produce its kind; here also is lodged the impetus to change and variation. Climate and soil and cultivation may assist the plant in its departure from the parent type, but that restlessness which renders the classification of some genera so difficult, is due more to the hidden force lodged by the plant in the nucellus than all other combined influences. It seems reasonable, therefore, that something of this inherent disposition of the plant that is to

be, ought to be manifest in the seed and so serve as a truer index to its position and relationship. And this fact, it seems to me, appears with unmistakable clearness in the case of our Eastern Orchids.

Explanation of Plates.

PLATE CL.

Fig. 1. Testa of *Acroanthes unifolia* × 100.
Fig. 1a. Same showing sculpturing of inner cell wall of testa × 325.
Fig. 2. *Liparis liliifolia*, seed × 100.
Fig. 3. *Calypso bulbosa*, seed × 60.
Fig. 3a. Same showing sculpturing of inner cell wall of testa × 325.
Fig. 4. *Tipularia unifolia*, seed × 100.
Fig. 4a. Same showing sculpturing of inner cell wall of testa × 325.
Fig. 5. *Aplectrum spicatum*, seed × 35.
Fig. 5a. Same showing sculpturing of inner cell wall of testa × 180.
Fig. 6. *Corallorhiza innata*, seed × 125.
Fig. 6a. Same showing sculpturing on inner cell wall of testa × 325.
Fig. 7. *Corallorhiza multiflora*, seed × 115.
Fig. 7a. Same showing sculpturing of inner cell wall of testa × 325.

PLATE CLI.

Fig. 8. *Hexalectris aphyllus*, seed × 100.
Fig. 8a. Same showing sculpturing on inner cell wall of testa × 175.
Fig. 9. *Bletia verecunda*, seed × 100.
Fig. 10. *Listera cordata*, seed × 100.
Fig. 11. *Listera australis*, seed × 100.
Fig. 12. *Listera convallarioides*, seed × 100.
Fig. 13. *Gyrostachys cernua*, seed × 120.
Fig. 13a. Same showing the sculpturing on inner cell wall of testa × 175.
Fig. 14. *Peramium repens*, seed × 55.
Fig. 15. *Peramium pubuscens*, seed × 75.
Fig. 16. *Epipactis viridiflora*, seed × 30.
Fig. 16a. Same showing cell wall over nucellus × 200.
Fig. 17a. Nucellus of same showing arragement of cells × 175.

PLATE CLII.

Fig. 17. *Arethusa bulbosa*, seed × 100.
Fig. 18. *Limodorum tuberosum*, seed × 100.
Fig. 19. *Pogonia ophioglossoides*, seed × 55.
Fig. 19a. Same showing sculpturing on inner cell wall of testa × 175.
Fig. 20. *Pogonia trianthophorus*, seed × 100.
Fig. 20a. Same showing sculpturing on inner cell wall of testa × 325.
Fig. 21. *Pogonia verticillata*, seed × 55.
Fig. 22. *Pogonia affinis*, seed × 55.
Fig. 23. *Orchis spectabilis*, seed × 60.
Fig. 24. *Habenaria ciliaris*, seed × 75.
Fig. 25. *Cypripedium pubescens*, seed × 30.
Fig. 25a. Same showing cell wall over nucellus × 100.

A List of the Grasses of Pennsylvania.

By Thos. C. Porter.

At the request of the Pennsylvania Board of Managers for the World's Fair, the author prepared a suite of all the grasses known to grow beyond culture within the bounds of the State, and these, mounted on card-boards, are now on exhibition in their building at Chicago. But, as no way seems to be open, through the parties who have the matter in charge, for issuing in pamphlet form for distribution a list copied from what is printed on the card-boards, he has deemed it his right to seek a channel in the pages of the Bulletin for putting on record and making accessible to the public the results of his labors. The list that follows, much enlarged by additional notes, is in fact a new work.

In it, the names of the counties in which the species were collected are given, with the names of the collectors. Wherever the latter are wanting that of the author is to be supposed. All these species thus noted can be verified by specimens in the Pennsylvania Herbarium of Lafayette College, either by a single one, or by several from different stations in the same county.

Besides this, the Flora of Darlington, for Chester county; that of Barton, for Philadelphia, and the Catalogues of Dr. George Smith, for Delaware; of Dr. I. S. Moyer, for Bucks, and of Professors Dudley and Thurston, for Lackawanna and Luzerne, are cited in brackets.

The numbers attached to the species correspond with those on the card-boards of the Chicago exhibit.

1. Paspalum setaceum, Mx.—In damp, sandy soils.—Delaware, *Dr. Geo. Smith;* Chester, *Porter,* (Fl. Cestrica); Philadelphia; Lancaster; Dauphin; Lebanon; Bucks, (Moyer's Cat.); Northampton.
2. Paspalum lævе, Mx.—Same habitat as the preceding.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Lancaster; York; Lebanon; Northampton.
3. Panicum filiforme, Linn.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Lancaster; Bucks (Moyer's Cat.); Crawford, *Garber.*

4. PANICUM GLABRUM (Schrad.) Gaud.—Nat. from Eu. Common.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Luzerne (Dudley and Thurston's Cat.); Dauphin; Lycoming, *Heller;* Erie, *Garber.*
5. PANICUM SANGUINALE, Linn.—Nat. from Eu. Very common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Franklin; Huntingdon.
6. PANICUM XANTHOPHYSUM, Gray.—In the northeastern counties. Rare.—Lycoming, on "dry slate hills," *McMinn:* Luzerne and Lackawanna, *Dudley.*
7. PANICUM DEPAUPERATUM, Muhl.—On dry hillsides. Frequent throughout.—Delaware; Chester (Fl. Cestrica); Lancaster; Lebanon, *Small;* Bucks (Moyer's Cat.); Schuylkill; Lycoming, *McMinn;* Tioga, *Garber;* Venango, *Garber.*
8. PANICUM SCOPARIUM, Lam.—Not common.—Lancaster; Chester; Northampton, at a few stations.
9. PANICUM DICHOTOMUM, Linn.—Common throughout. Exceedingly variable.—Delaware; Chester; Lancaster; Bucks (Moyer's Cat.); Northampton.
12. PANICUM DICHOTOMUM, L., var. BARBULATUM (Michx.) Vasey.—Chester; Lancaster; Northampton.—Often found with the typical form.
13. PANICUM RAMULOSUM, Michx. (?)—In woods. Frequent throughout.—Chester; Lancaster; Northampton; Carbon, *Kraut;* Huntingdon.
14. PANICUM RAMULOSUM, Michx. (?), var. VIRIDE (Vasey.)—Lancaster; Chester; Northampton.—A delicate grass, entirely glabrous, with slender culms and linear or lance-linear leaves. Growing with the typical form.
15. PANICUM WALTERI, Poir. (*P. latifolium* of Am. authors, not of Linnæus.)—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Luzerne (Dudley and Thurston's Cat.); Huntingdon; Bedford; *Small;* Carbon, *Kraut.*
16. PANICUM WALTERI, Poir., var. MOLLE (Vasey.)—Rare.—Bucks, *H. F. Ruth;* Northampton; Luzerne (Dudley and Thurston's Cat.).

17. PANICUM COMMUTATUM, Schultes.—Rare.—Lancaster; Northampton.
18. PANICUM SPHÆROCARPON, Ell.—Not common.—Chester; Northampton; Luzerne, *Heller.*
19. PANICUM UNCIPHYLLUM, Trin.—Chester, on the serpentine barrens south of Oxford.
20. PANICUM CLANDESTINUM, Linn.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Northampton; Lancaster; Franklin; Luzerne (Dudley and Thurston's Cat.).—Frequent throughout.
21. PANICUM CLANDESTINUM, L., var. PEDUNCULATUM, Torr.—Philadelphia, *Dr. Jos. Leidy;* Lancaster; Chester; Franklin; Huntingdon; Venango, *Garber.*
22. PANICUM VISCIDUM, Ell.—Delaware, at Tinicum, *Aubrey H. Smith.*
23. PANICUM MICROCARPON, Muhl.—Delaware, *Charles E. Smith;* Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Lancaster; Perry, on the shores of the Susquehanna.
24. PANICUM CAPILLARE, Linn.—Common throughout.—Delaware (Smith's Cat.); Chester; Bucks; Lancaster; Northampton; Huntingdon.
25. PANICUM CAPILLARE, L., var. FLEXILE, Gattinger.—Very rare.—Lancaster, in a swamp near Dillerville. The only known station in the State.
26. PANICUM PROLIFERUM, Lam.—Not uncommon.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Lancaster; Dauphin; Northampton.
27. PANICUM MILIACEUM, Linn.—Fug. from Eu.—Dauphin; Lancaster; Luzerne, *Small* and *Heller.*
28. PANICUM VERRUCOSUM, Muhl.—Very rare.—Delaware, at Tinicum, the only station known in the State.
29. PANICUM ANCEPS, Michx.—Not common.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Lancaster; Lebanon, *Small;* Bucks, *Diffenbaugh;* Lehigh; Northampton.
30. PANICUM AGROSTOIDES, Muhl.—Common in wet places.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Lancaster; Dauphin; Northampton.
31. PANICUM VIRGATUM, Linn.—On rocky shores. Throughout

the State.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Luzerne, *Heller;* Dauphin; Huntingdon, *Lowrie;* Erie, *Clinton, Garber.*

32. PANICUM CRUS-GALLI, Linn.—Nat. from Eu. Common.—Delaware (Smith's Cat.); Chester; Bucks (Moyer's Cat.); Lancaster; Franklin; Northampton.

33. PANICUM AMARUM, Ell., var. MINOR, Vasey & Scribner.—Philadelphia, *Diffenbaugh.* A plant of the coast of New Jersey, introduced and spreading from ballast-heaps.

34. CHAMÆRAPHIS VERTICILLATA (L.). (*Setaria verticillata*, Beauv.).—Adv. from Eu. Not common.—Bucks (Moyer's Cat.); Northampton; Lancaster.

35. CHAMÆRAPHIS GLAUCA (L.) Kuntze. (*Setaria glauca*, Beauv.).—Nat. from Eu. Common throughout.—Delaware (Smith's Cat.); Chester; Philadelphia (Barton's Flora); Bucks (Moyer's Cat.); Lancaster; Huntingdon, *Lowrie;* Northampton.

36. CHAMÆRAPHIS VIRIDIS (L.). (*Setaria viridis*, Beauv.).—Nat. from Eu. Very common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Franklin; Lancaster.

37. CHAMÆRAPHIS ITALICA (L.) Kuntze. (*Setaria Italica*, Kunth).—Adv. from Eu. Escaped from culture.—Chester (Fl. Cestrica); Northampton; Luzerne (Dudley and Thurston's Cat); Lycoming, *Small and Heller.*

38. CENCHRUS TRIBULOIDES, Linn.—Chester (Fl. Cestrica); Delaware (Smith's Cat.); Bucks, (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Dauphin; Lancaster; Northampton.—Sandy river banks and fields.

39. SPARTINA CYNOSUROIDES (Linn.) Willd.—Not common. Rocky shores of the large rivers.—Chester (Fl. Cestrica); Philadelphia, *E. Diffenbaugh;* Bucks, *H. F. Ruth;* York; Dauphin; Allegheny, *Knipe;* Venango, *Kraut;* Erie, *Garber.*

40. SPARTINA JUNCEA (Michx.) Willd.—A salt-marsh plant, common on the New Jersey coast. Introduced upon ballast-grounds.—Philadelphia, *Diffenbaugh.*

41. TRIPSACUM DACTYLOIDES, Linn.—Rare and local.—Berks, near Reading, *Dr. J. P. Hiester;* Chester, in the Great Valley, (Fl. Cestrica); Lancaster, on the Lower Susquehanna.

42. ZIZANIA AQUATICA, Linn.—Swampy margins of rivers.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia; Bucks (Moyer's Cat.); Lancaster, above Shock's Mill.

43. HOMALOCENCHRUS VIRGINICUS (Willd.) Britton.—Common in wet places.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Franklin, *Traill Green;* Huntingdon; Luzerne (Dudley and Thurston's Cat.).

44. HOMALOCENCHRUS ORYZOIDES (Linn.) Poll.—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Northampton; Lancaster.

45. ERIANTHUS ALOPECUROIDES (Linn.) Ell.—Very rare and local.—Bucks, *Burk, I. C. Martindale.*

46. ANDROPOGON PROVINCIALIS, Lam., (*A. furcatus*, Muhl.).—Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia (Barton's Flora); Lancaster; Bucks (Moyer's Cat.); Northampton; Luzerne (Dudley and Thurston's Cat.); Huntingdon, *Lowrie.*

47. ANDROPOGON SCOPARIUS, Michx.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia (Barton's Fl.); Bucks (Moyer's Cat.); Northampton; Luzerne (Dudley and Thurston's Cat.); Lancaster; Dauphin; Lebanon, *Small;* Centre, *Rothrock;* Blair, *Bœcking;* Erie, *Clinton.*—Common over the whole State.

48. ANDROPOGON VIRGINICUS, Linn.—Not frequent.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia (Barton's Fl.); Bucks (Moyer's Cat.); Lancaster; Northampton; Luzerne (Dudley and Thurston's Cat.).

49. ANDROPOGON GLOMERATUS (Walt.), B. S. P.—Rare.—Delaware, *Charles E. Smith;* Chester (Fl. Cestrica); Lancaster.

50. CHRYSOPOGON NUTANS (Linn.) Benth.—On rocky banks; frequent.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Luzerne (Dudley and Thurston's Cat.); Huntingdon, *Bœcking.*

50a. SORGHUM HALAPENSE (Linn.) Pers.—Fugitive. Escaped from culture.—Philadelphia, *Burk.*

51. PHALARIS CANARIENSIS, Linn.—Fug. from Eu.—Lancaster; Philadelphia, *Charles E. Smith;* Northampton, *Tyler.*

52. PHALARIS ARUNDINACEA, Linn.—In wet places. Common throughout.—Delaware (Smith's Cat.); Philadelphia (Barton's Fl.); Chester (Fl. Cestrica); Lancaster; Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Huntingdon, *Lowrie*.
53. ANTHOXANTHUM ODORATUM, Linn.—Nat. from Eu.—Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia; Bucks (Moyer's Cat.); Berks; Monroe; Blair, *Lowrie*.
54. ALOPECURUS GENICULATUS, Linn.—Fug. from Eu.—Philadelphia, *Diffenbaugh*.—On the ballast heaps.
55. ALOPECURUS GENICULATUS, Linn., var. ARISTULATUS (Michx.), Munro.—Rare and local.—Delaware (Smith's Cat.); Huntingdon; Luzerne, *Thurston*.
56. ARISTIDA DICHOTOMA, Linn.—Common throughout.—Delaware (Smith's Cat.); Chester; Lancaster; Lebanon; Bucks (Moyer's Cat.); Philadelphia (Barton's Fl.); Northampton.
57. ARISTIDA GRACILIS, ELL.—Dry roadsides. Less common than the former.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Franklin.
58. ARISTIDA PURPURASCENS, Poir.—Not common.—Bucks (Moyer's Cat.); Northampton; Lancaster; York.—On sandy river-banks.
59. STIPA AVENACEA, Linn.—Very rare and local.—Delaware; Chester, *J. J. Carter;* Philadelphia, *Diffenbaugh*.
60. ORYZOPSIS MELANOCARPA, Muhl.—Frequent. In rocky woods.—Bucks (Moyer's Cat.); Philadelphia, *Chas. E. Smith;* Lancaster; Luzerne, *Small* and *Heller;* Huntingdon, *Lowrie*.
61. ORYZOPSIS ASPERIFOLIA, Michx.—Rare.—Monroe; Luzerne Dudley and Thurston's Cat.); Huntingdon; Blair, *Lowrie;* Erie, *Guttenberg*.
62. ORYZOPSIS JUNCEA (Michx.) B. S. P.—Very rare. In the mountain regions.—Monroe, near Naomi Pines; Luzerne, *Rothrock*.
63. MILIUM EFFUSUM, Linn.—Rare. In the northern counties.—Wayne, *Garber;* Sullivan, *Chas. E. Smith;* Mercer, *Garber*.
64. MUHLENBERGIA SOBOLIFERA (Muhl.) Trin.—Frequent throughout. In rocky woods.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Huntingdon, *Lowrie*.

65. MUHLENBERGIA RACEMOSA (Michx.) B. S. P.—In bogs. Not common.—Chester (Fl. Cestrica); Bucks, *H. F. Ruth;* Lancaster; Monroe; Lycoming, *McMinn;* Crawford, *Garber.*

66. MUHLENBERGIA MEXICANA (Linn.) Trin.—Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Franklin; Huntingdon; Clearfield, *McMinn.*

67. MUHLENBERGIA SYLVATICA (Torr.) T. and G.—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Lancaster; Lebanon, *Small;* Clearfield, *McMinn.*

68. MUHLENBERGIA TENUIFLORA (Willd.) B. S. P.—Not rare. In rocky woods.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Huntingdon; Blair, *Lowrie.*

69. MUHLENBERGIA DIFFUSA, Schreb.—Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks, (Moyer's Cat.); Northampton; Lancaster; Blair, *Bœcking;* Huntingdon, *Lowrie.*

70. MUHLENBERGIA CAPILLARIS, Kunth.—Very rare.—Lancaster, at Safe Harbor, the only station known in the State (Oct. 8, 1864).

71. BRACHYELYTRUM ARISTOSUM (Michx.) B. S. P.—Common throughout. In rocky woods.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Lancaster; Northampton.

72. HELEOCHLOA SCHŒNOIDES (Linn.) Host.—Nat. from Eu.—Philadelphia (*Crypsis Virginica* of Barton's Fl., 1, p. 45), *James, Burk, Diffenbaugh;* Delaware, *Dr. G. Smith;* Lancaster, at Columbia, *Garber.*

73. PHLEUM PRATENSE, Linn.—Nat. from Eu.—Common throughout.—Lancaster, *Small;* Franklin; Northampton.

74. SPOROBOLUS ASPER (Michx.) Kunth.—Rare. On sandy riverbanks.—Dauphin; Lancaster; Montgomery, *Diffenbaugh;* Northampton.

75. SPOROBOLUS VAGINÆFLORUS (Torr.) Vasey.—Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Lancaster; Northampton; Huntingdon; *Lowrie.*

76. SPOROBOLUS INDICUS (L.) R. Br.—From Trop. Am.—Philadelphia, *C. F. Parker.*—Spreading to waste places from the ballast-heaps.

77. SPOROBOLUS HETEROLEPIS, Gray.—Very rare and local.—Lancaster, near New Texas, *J. J. Carter.* The only station known.

78. SPOROBOLUS CRYPTANDRUS (Torr.) Gray.—Erie, on Presque Isle, *Garber*, (Sept. 1868).

79. AGROSTIS PERENNANS (Walt.) Tuck.—Common throughout. In damp woods.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Northampton; Dauphin; Lancaster; Centre, *Lowrie;* Huntingdon, *Bœcking.*

80. AGROSTIS HIEMALIS (Walt.) B. S. P.—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Monroe; Lancaster.

81. AGROSTIS CANINA, Linn.—Rare. In the mountain regions.—Northampton; Dauphin, *Small;* Blair, *Lowrie.*

82. AGROSTIS ALBA, Linn.—Nat. from Eu. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Monroe; Lycoming; Huntingdon, *Lowrie;* Lycoming.

83. AGROSTIS ALBA, Linn., var. VULGARIS (With.) Thurber.—Frequent throughout. Everywhere with the typical form.—Northampton; Monroe.

84. CINNA ARUNDINACEA, Linn.—Delaware (Smith's Cat.) Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Lackawanna (Dudley and Thurston's Cat.); Lancaster; Northampton; Huntingdon; Blair, *Bœcking.*

85. CINNA PENDULA, Trin.—Rather frequent on the mountains of the northern counties.—Monroe; Lackawanna; Huntingdon, *Garber;* Blair, *Lowrie.*

86. CALAMAGROSTIS CANADENSIS (Michx.) Beauv.—Abundant in the mountain-swamps of the State.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (*H. F. Ruth*); Northampton; Lancaster; Dauphin; Carbon; Monroe; Elk, *McMinn;* Tioga, *Garber;* Venango, *Garber;* Erie, *Garber.*

87. CALAMAGROSTIS CONFINIS, Nutt.—Very rare and local.—Lycoming, in a bog near Muncy, *McMinn* (1865).

88. CALAMAGROSTIS NUTTALLIANA, Steud.—Rather frequent in bogs and damp woods.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks, *H. F. Ruth;* Monroe; Lancaster; Lebanon, *Heller;* Dauphin; Huntingdon.

89. CALAMAGROSTIS PORTERI, Gray.—Local and not common.—Huntingdon. Discovered by the author in dry woods on the hills along the Little Juniata river near Barree Forge, Aug. 12, 1862. Afterwards it was found on Warrior's Ridge, by *J. R. Lowrie*, near Warriorsmark in the same county. It was also reported in Prof. Dudley's Flora as growing in Cayuga Co., N. Y. Specimens of the preceding species which sometimes has the leaves bearded below the junction of the blades with the sheath have been mistaken for it.

90. AMMOPHILA ARENARIA (Linn.) Link.—Erie, *G. W. Clinton.*—A coast-plant collected on Presque Isle, the only station known in the State.

91. AIRA PRÆCOX, Linn.—Adv. from Eu. Northampton, near Bethlehem, *Fiot*—the only known station.

92. AIRA CARYOPHYLLEA, Linn.—Fug. from Eu.—Philadelphia, on ballast-heaps, *I. C. Martindale.*

93. DESCHAMPSIA FLEXUOSA (Linn.) Griseb.—Not frequent. On rocky banks and cliffs.—Lackawanna (Dudley and Thurston's Cat.); Monroe, *Knipe;* Lancaster; Franklin.

94. DESCHAMPSIA CÆSPITOSA (Linn.) Beauv.—Very rare and local.—Chester (Fl. Cestrica); Lancaster; Monroe, *Traill Green.*

95. HOLCUS LANATUS, Linn.—Nat. from Eu. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Northampton; Lancaster.

96. TRISETUM PENNSYLVANICUM (Linn.) B. S. P.—In swamps. Sparingly throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Dauphin; Lancaster; Lycoming, *McMinn.*

97. AVENA STRIATA, Michx.—Very rare. A northern species.—Sullivan, *Aubrey H. Smith, Chas. E. Smith;* Elk, *McMinn.*

98. ARRHENATHERUM ELATIUS (Linn.) Mert. and Koch.—Adv. from Eu. Rare. Found occasionally along roadsides and in woods.—Chester (Fl. Cestrica); Lancaster, *Small;* Northampton.

99. DANTHONIA SPICATA (Linn.) Beauv.—Very common throughout. In open woods and on dry hillsides.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Monroe; Lycoming, *McMinn.*

100. DANTHONIA COMPRESSA, Austin.—Rare. A mountain species.—Monroe, *Britton;* Berks; *Crawford;* Lackawanna; Lycoming, *McMinn.*

101. DANTHONIA SERICEA, Nutt.—Lycoming, *McMinn.* "On dry slate hills." Very rare.

102. CAPRIOLA DACTYLON (L.) Kuntze. (*Cynodon Dactylon*, Pers.).—Introduced from Europe and spreading from ballast-heaps.—Philadelphia, *Diffenbaugh;* Bucks, at Bristol, *Diffenbaugh;* Bethlehem, *Bechdolt.*—Abundant in the South.

103. BOUTELOUA CURTIPENDULA (Michx.) A. Gray.—Rare.—Chester (Fl. Cestrica); Northampton; Lancaster; Huntingdon, *Lowrie.*

104. ELEUSINE INDICA (Linn.) Gært.—Nat. from India. Very common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Northampton; Huntingdon, *Lowrie.*

105. ELEUSINE ÆGYPTIACA (Willd.) Pers.—Adv. from Eu.—Delaware, "established at some places and spreading," *Dr. G. Smith;* Philadelphia, *Diffenbaugh.*—Spreading from ballast-heaps.

106. SIEGLINGIA FLAVA (L.) Kuntze. (*Triodia sesleroides*, Benth.).—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Lancaster; Northampton; Luzerne (Dudley and Thurston's Cat.); Huntingdon.

107. TRIPLASIS PURPUREA (Walt.) Beauv.—Erie, on Presque Isle, *Garber.*—A coast-plant. The only station known in Pennsylvania.

108. PHRAGMITES VULGARIS (Lam.) B. S. P.—Rare and local.—Delaware, *Dr. G. Smith;* Chester (Fl. Cestrica); Erie, on Presque Isle, *Garber.*

109. KŒLERIA CRISTATA, Pers.—Very rare.—Found only on Campbell's Ledge, on the Susquehanna river above Moeanaqua (Dudley and Thurston's Cat.), *Dudley.*

110. EATONIA PENNSYLVANICA (Spreng.) A. Gray.—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks, *H. F. Ruth;* Northampton; Lancaster; Tioga, *Garber.*

111. EATONIA OBTUSATA (Michx.) A. Gray.—Rare and local.—Chester (Fl. Cestrica); Lancaster.

112. EATONIA DUDLEYI, Vasey.—Rather frequent in the central mountain-region.—Lancaster; Lehigh, *Garber;* Monroe, *Britton;* Huntingdon, *Lowrie.*

113. ERAGROSTIS HYPNOIDES (Lam.) B. S. P.—Common along sandy river-shores.—Franklin; Lancaster; Bucks, *H. F. Ruth;* Tioga, *Garber;* Huntingdon, *Lowrie;* Northampton.

ERAGROSTIS MINOR, Host.—Adv. from Eu. Rare.—Franklin, *Traill Green;* Bucks.

114. ERAGROSTIS MAJOR, Host.—Nat. from Eu. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Philadelphia, *Diffenbaugh;* Lancaster; Franklin; Huntingdon, *Lowrie.*

115. ERAGROSTIS PILOSA (Linn.) Beauv.—Nat. from Europe. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Monroe, *Knipe;* Lancaster; Franklin, *Traill Green;* Fayette, *Garber.*

116. ERAGROSTIS PURSHII, Schrad. Frequent in the eastern counties. On sandy river-banks.—Northampton; Dauphin; Lancaster, *Heller.*

117. ERAGROSTIS FRANKII, Meyer.—Rare and local.—Chester, *Canby;* Lancaster; Monroe, *Knipe;* Northampton.

118. ERAGROSTIS CAPILLARIS (Linn.) Nees.—Frequent throughout.—Chester (Fl. Cestrica); Delaware (Smith's Cat.); Northampton; Lancaster; Huntingdon, *Lowrie, Boecking.*

ERAGROSTIS PECTINACEA (Michx.) A. Gray.—Rare. Bucks, *I. C. Martindale.*

119. ERAGROSTIS PECTINACEA (Michx.) A. Gray, var. SPECTABILIS, A. Gray. Frequent in the eastern counties.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Philadelphia, *James;* Lancaster.

120. MELICA MUTICA, Willd.—Berks, near Reading, *Dr. J. P. Hiester;* Lancaster, at Safe Harbor.—Very rare and local.

121. UNIOLA LATIFOLIA, Michx.—Rare and local.—Lancaster, shores of the Susquehanna, *Diffenbaugh, Heller.*

122. UNIOLA LAXA (Linn.) B. S. P.—Very rare and local.—Delaware, at Tinicum, *Chas. E. Smith;* Bedford, *Aubrey H. Smith.*

123. DISTICHLIS SPICATA (Linn.) Greene.—Philadelphia, *Parker.*—From the ballast-heaps. Common on the sea-coast of New Jersey.

124. DACTYLIS GLOMERATA, Linn.—Nat. from Eu. Escaped from culture and common throughout.—Northampton.

BRIZA MAXIMA, Linn.?—Lancaster, on the roadside near Smithville, *Small.*—Fug. from Eu.

125. FESTUCA MYURUS, Linn.—Nat. from Eu.—Bucks, near Quakertown, *Dr. J. B. Brinton*—the only station known in Pennsylvania. Common in Southern New Jersey.

126. POA ANNUA, Linn.—Nat. from Eu. Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Northampton; Lancaster; Huntingdon, *Lowrie;* Blair, *Boecking.*

127. POA COMPRESSA, Linn.—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Northampton; Lancaster; Franklin; Allegheny, *Knipe.*

128. POA SEROTINA, Ehrh.—Rare and local.—Tioga, *Garber;* Crawford, *McMinn.*

129. POA PRATENSIS, Linn.—Nat. From Eu. Very common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Northampton; Lancaster; Franklin; Blair, *Boecking;* Erie, *Garber.*

130. POA TRIVIALIS, Linn.—Nat. from Eu. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Philadelphia, *James;* Northampton; Lancaster; Centre, *Boecking;* Clinton, *McMinn.*

131. POA SYLVESTRIS, Gray.—Rare and local.—Bucks, *Garber;* Wayne, *Garber;* Chester, at Valley Forge, *Diffenbaugh;* Lancaster.

132. POA DEBILIS, Torr.—Very rare.—Monroe, *Brinton,* at Naomi Pines, the only known station.

133. POA ALSODES, Gray.—Very rare.—Sullivan, on the Loyalsock, *Chas. E. Smith.*

134. POA FLEXUOSA, Muhl.—Rare and local.—Sullivan, on the Loyalsock, *Chas. E. Smith;* Lackawanna, near Moscow, *Thurston;* Lancaster, Bart and Martic Townships.

135. Poa brevifolia, Muhl.—Not common. On rocky river-banks. Flowers early. — Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks, *H. F. Ruth;* Philadelphia, *Diffenbaugh;* Northampton; Lancaster; Huntingdon.

136. Panicularia Canadensis (Michx.) Kuntze. (*Glyceria Canadensis*, Trin.).—Frequent in the swamps of the mountain-regions.—Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Lancaster; Schuylkill; Monroe; Centre.

137. Panicularia obtusa (Nutt.) Kuntze.—Rare and local.—Clearfield, *McMinn;* Monroe, near Tobyhanna Mills.

138. Panicularia elongata (Torr.) Kuntze.—Frequent along the mountain-streams of the Alleghenies.—Bucks (Moyer's Cat.); Carbon; Monroe; Franklin; Tioga, *Garber;* Cameron.

139. Panicularia nervata (Willd.) Kuntze.—Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne (Dudley and Thurston's Cat.); Monroe; Lancaster; Tioga, *Garber;* Huntingdon, *Lowrie.*

140. Panicularia pallida (Eddy) Kuntze.—Rare and local.—Philadelphia, *Dr. Jos. Leidy:* Bucks, *Fretz;* Monroe; Wayne, *Garber.*

141. Panicularia Americana (Torr.) MacMillan.—(*Glyceria arundinacea*, Kunth).—Not common.—Lancaster, Bart township; Bucks, *H. F. Ruth;* Northampton; Monroe; Tioga, *Garber;* Huntingdon, *Lowrie;* Clarion, *Garber.*

143. Panicularia fluitans (Linn.) Kuntze.—Frequent in shallow waters throughout the State.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Franklin; Lancaster; Northampton; Huntingdon.

144. Panicularia brevifolia (Muhl.). (*Glyceria acutiflora*, Torr.) Very rare and local.—Bucks (Moyer's Cat.); Huntingdon.

145. Puccinellia distans (Linn.) Parl.—Philadelphia, *Diffenbaugh.* A species of the sea-coast, introduced and spreading from the heaps of ballast.

145. Festuca octoflora, Walt. (*F. tenella*, Willd.).—Not common. In dry soils.—Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Huntingdon, *Lowrie;* Erie, *Garber.*

146. Festuca duriuscula, Linn.—Nat. from Eu. Rare.—Bucks

(Moyer's Cat.); Northampton, *Fiot, Garber;* Chester, *Burk;* Erie, *Garber.*

147. FESTUCA ELATIOR, Linn.—Nat. from Eu. Common throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Franklin; Northampton; Lancaster; Huntingdon, *Lowrie;* Blair, *Boecking.*

148 FESTUCA NUTANS, Spreng.—Frequent throughout. In rocky woods.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Huntingdon, *Lowrie;* Venango, *Garber.*

149. BROMUS SECALINUS, Linn.—Adv. from Eu. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Luzerne and Lackawanna (Dudley and Thurston's Cat.); Northampton; Lancaster; Franklin; Huntingdon, *Lowrie.*

150. BROMUS RACEMOSUS, Linn.—Adv. from Eu. Common throughout.—Bucks (Moyer's Cat.); Philadelphia; Lancaster; Northampton.

151. BROMUS MOLLIS, Linn.—Fug. from Eu. Very rare.—Chester, *Canby.*

152. BROMUS KALMII, Gray.—Rare.—Northampton; Bucks, *Fretz;* Lancaster, *Small;* Huntingdon, *Lowrie;* Venango, *Garber.*

153. BROMUS CILIATUS, Linn.—Common throughout. In rocky woods.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia, *I. C. Martindale;* Northampton; Lancaster.

154. BROMUS PURGANS, Linn.—Frequent throughout. On banks of streams. Flowers much later than *B. ciliatus.*—Northampton; Huntingdon, *Lowrie.*

155. BROMUS STERILIS, Linn.—Adv. from Eu. Not common.—Philadelphia, *Canby, Chas. E. Smith;* Northampton, at Easton.

156. BROMUS TECTORUM, Linn—Adv. from Europe.—Rare.—Northampton, streets of Easton.

157. LOLIUM PERENNE, Linn.—Nat. from Eu. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia, *Chas. E. Smith;* Bucks (Moyer's Cat.); Northampton; Lancaster; Franklin.

158. LOLIUM TEMULENTUM, Linn.—Adv. from Eu. Very rare.—Philadelphia, *Chas. E. Smith;* Northampton, near Easton.

159. AGROPYRUM REPENS (Linn.) Beauv.—Nat. from Eu. Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Philadelphia; Northampton; Lancaster.

AGROPYRUM VIOLACEUM (Horn.) Lange.—Rare and local.—Huntingdon, in the barrens near Birmingham, *Miss Davis;* Venango, *Garber.*

160. AGROPYRUM CANINUM (Linn.) Rœm. and Sch.).—Very rare and local.—Monroe, near Pocono Summit.

161. HORDEUM JUBATUM, Linn.—Fug. from Eu.—Berks, *Oberly;* Philadelphia, *Diffenbaugh.*

162. ELYMUS VIRGINICUS, Linn.—Frequent throughout.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia (Barton's Fl.); Bucks (Moyer's Fl.); Northampton; Lancaster; Franklin; Blair, *Lowrie.*

163. ELYMUS CANADENSIS, Linn.—Common throughout. On river-banks.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Philadelphia (Barton's Fl.); Bucks (Moyer's Cat.); Northampton; Lancaster; Bedford, *Small.*

164. ELYMUS CANADENSIS, Linn., var. GLAUCIFOLIUS, A. Gray. Frequent on rocky banks and cliffs along rivers.—Northampton; Dauphin.

165. ELYMUS STRIATUS, Willd.—Frequent along the banks of streams.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Northampton; Franklin; Huntingdon.

166. HYSTRIX PATULA, Mœnch. (*Asprella Hystrix*, Willd.). Frequent throughout the State.—Delaware (Smith's Cat.); Chester (Fl. Cestrica); Bucks (Moyer's Cat.); Northampton; Lancaster; Franklin; Luzerne, *Heller;* Huntingdon, *Lowrie.*

Solidago humilis, Pursh, of the Eastern States, and its Allies.

(PLATES CLIII.–CLV.)

Solidago Virgaurea, L. has long been regarded as native in the higher latitudes of North America, and appears as such in the Flora of Torrey and Gray. In the 5th edition of his Manual, which covers less territory, Dr. Gray admits the species, but restricts it to two varieties, *alpina*, Bigelow, and *humilis* (Pursh).

In the Synoptical Flora Bigelow's variety alone is retained and Pursh's *humilis* restored to specific rank, but with its compass so enlarged as to embrace a number of diverse and ambiguous forms, amongst which are some that cannot be distinguished from European specimens of *S. Virgaurea* on the one hand, and are clearly separated, on the other, from *S. humilis* by their more robust habit, broader leaves and sharp-pointed involucral scales.

A recent study of these perplexing goldenrods in the herbaria of Columbia College, Lafayette College and the Philadelphia Academy of Natural Sciences, and especially in the large collections made during the last two or three years by Messrs. Rand and Redfield on Mount Desert Island, Maine, has led me to dispose of them as follows:

Solidago Virgaurea, L.—In his description of the type of the species De Candolle (Prod. v. 338) writes: "*mire varians, sed veris. in plures species non divellenda et imo varietatibus vix inter se satis diversis conflata*"—words that well express its behavior also on this side of the Atlantic.

Specimens collected at the Willey House, Notch of the White Mountains, N. H., by *Oakes*, *Pringle*, *Edwin Faxon* and others, and on Willoughby Mountain, Vt., by *Rusby*, tally with forms brought from the Isle of Wight and Sunningdale, England, by *Dr.* and *Mrs. Britton*, whilst others collected by *Dr. Morong* in the mountains of New Hampshire, and on Mt. Desert Island by Rand and Redfield, are very like the varieties *angustifolia*, Gaud. and *ericetorum*, DC. of the Old World, and in their foliage approach typical *S. humilis* of the New. (Plate CLIII.)

Besides those already recognized, I venture to characterize several more varieties, peculiar to our flora.

Solidago Virgaurea, L., var. RANDII, n. var. More or less glutinous; stems stout, erect, 1–2 ft. high, often dark purple, puberulent, or sometimes glabrate below; radical and lower leaves obovate or oblanceolate, acute, serrate, cauline lanceolate or elliptical-lanceolate, sparingly serrate or entire, glabrous; inflorescence an ample branched panicle or loose virgate thyrse; heads 3 lines or more long; outer scales of the involucre mostly ovate or lance-ovate and bluntish, sometimes almost linear and acute, inner ones oblong-linear, yellowish, with scarious margins and acute or

acuminate tips; achenes pubescent or nearly smooth.—Named in honor of Mr. Edward L. Rand.

Rather common on the mountains of Northern New England and New York; abundant on Mt. Desert Island, Me., *Rand* and *Redfield;* shores of Lake Champlain, Vt., *Pringle.* Passes gradually into the next.

Solidago Virgaurea, L., var. *monticola.* (*S. puberula*, Nutt., var. *monticola*, Porter, BULLETIN xix. 129.)

Stems 3 to 12 inches high, often slender; inflorescence a short, compact or sometimes loose thryse, 2 to 4 inches long; heads 1½ to 3 lines long; scales of the involucre variable, ovate and bluntish or oblong and obtuse, inner ones not elongated.

Common on the highest points of Mt. Desert Island, *Rand* and *Redfield;* Mt. Kineo, Me., *Porter;* summit of Mt. Monadnock (el. 3169 ft.), *Deane;* Willoughby Mountain, Vt., *Rusby.*

Solidago Virgaurea, L., var. REDFIELDII, n. var.—Very glutinous. Stems stout snd rigid, 16–18 inches high; leaves thickish or coriaceous; branches of the panicle starting from half way down the stem or even from the base, strict, erect, bearing short clusters of heads in the upper bracts; heads small, 2–3 lines long; scales of the involucre short, more or less scarious. Its inflorescence is strikingly like that of *S. juncea*, Ait., var. *ramosa*, Porter and Britton.—Named in honor of *Mr. John H. Redfield.*

Western Mt. and Frenchman Camp Road, Mt. Desert Island, Me., *Rand and Redfield;* Summit Rock, Indian Pass, Adirondacks, N. Y. (el. 2600 ft.), *Dr. Britton.*

Solidago Virgaurea, L., var. GILMANII (A. Gray).

Solidago humilis, Pursh.—Stems slender, strict, minutely puberulent above, 4–18 inches high, the dwarf and taller ones growing together and often from the same roots, leafy; radical and lower leaves narrowly oblanceolate, and attenuated downward into slightly-margined petioles, serrulate above the middle, cauline ones lance-linear, entire, acute, glabrous; inflorescence glutinous, in the dwarf forms a short raceme, in the taller ones a loose or compact, virgate thyrse 5–8 inches long; heads 3–4½ lines high; scales of the involucre oblong-linear, obtuse, or the inner ones acutish, sometimes golden-yellow; achenes pubescent. (Plate CLV.)

On the rocky shores of rivers. Onion River, Vermont, *Rob-*

bins, Oakes; McCall's Ferry, on the Susquehanna, York Co., Pa., *Porter;* Great Falls of the Potomac, *Vasey.*

This is the type of the species according to Dr. Gray, and it agrees with the description in Pursh's Flora. In Northern New England and New York, and further northward and westward, in the Rocky Mountains and beyond, occur forms with broader leaves, smaller heads of flowers and shorter and more obtuse involucral scales, which have been placed under *S. humilis.* But they vary much, and their relations to the type must be left to future investigation.

The variety *microcaphala*, Porter (BULLETIN xix. 129), which was founded on a single specimen, proves to be on closer inspection a remarkable form of *S. nemoralis*, Ait.

Solidago alpestris, Wald. and Kit. (*S. Virgaurea*, L., var. *alpestris* (Koch), L. and var. *alpina*, Bigelow).—Alpine; stem glabrous or somewhat pubescent, 3–10 inches high, in the larger forms often bent, angular; radical leaves obovate, appressed-serrate above the middle, obtuse or acute, cauline oblanceolate or spatulate, of equal size, or 2 or 3 of the uppermost larger, longer and spreading, narrowed toward the base, obtuse or acute, sparingly serrate, distant; inflorescence a short raceme or thyrse with clusters of a few heads in the axils of the long upper leaves; heads 3–4 lines high; scales of the involucre acute; rays variable in length and breadth; achenes pubescent. (Plate CLIV.)

Summits of Mt. Katahdin, Me., the White Mountains, N. H., and Mt. Marcy (5300 ft.) and Mt. McIntyre (5100 ft.), N. Y.

At the highest elevations dwarfing obscures some of its characters, but the abundance of fine specimens obtained last summer by Dr. Britton in the Adirondacks exhibits the species in its fullest development, and on comparing them with *S. alpestris* from the Swiss and Carpathian Alps of Europe and the Altai Mountains of Asia the differences are so slight that the two must be regarded as identical. And such a conclusion ought to cause no surprise, when we consider the notable company of Old World alpines which occupy the same mountain-tops. This only adds one more to the number. From the polymorphous *S. Virgaurea* of Linnæus, spread over Europe at lower altitudes, the divergence is so wide that it may well be counted a good species. Koch

himself was inclined to think so, as appears from his remark in the Flora Germanica (p. 341): "*Varietates hic enumeratæ plures, ut mihi videtur, species constituunt, sed hucusque nondum satis observatæ sunt.*"

Dr. Gray was inclined to connect our plant with the other European alpine variety, *Cambrica*, but that has oblong-lanceolate leaves which are pilose on both sides. THOS. C. PORTER.

Francis Wolle.

After a painful and protracted illness, Rev. Francis Wolle died at his home in Bethlehem, Pa., February 10th.

He was born at Jacobsburg, Northampton Co., Pa., December 17, 1817. His ancestors, for two generations, were conspicuously associated with the Moravian Society, and during his long and useful life he was always prominent in Moravian church and educational affairs. Although a few of his earlier years were spent in business, he soon turned his attention to teaching as his life-work, and in 1857 he became vice principal of the celebrated Moravian Seminary for Young Ladies at Bethlehem, Pa. In 1861 he became principal of the institution, and conducted its affairs with marked ability until 1881, when the increasing infirmities of age necessitated his seeking rest.

From his childhood the study of natural history was his favorite pursuit, and after his retirement from active professional work, in 1881, he devoted himself to it with more ardor than ever. He was especially known among botanists as an authority upon fresh-water algæ and desmids. In 1884 he published his "Desmids of the United States and list of Pediastrums." The volume contained 1100 illustrations on 53 colored plates. This was followed in 1887 by two volumes on "The Fresh-Water Algæ of the United States, complemental to Desmids of the United States." This work was illustrated by 117 colored plates, embracing 2300 figures. In 1891 he brought out a work upon the "Diatomaceæ of the United States." This contained 2300 figures on 120 plates. All of the illustrations enumerated were photo-lithographs from India ink sketches made by the author. During 1892 there appeared a revised and enlarged edition of the "Desmids of the United States."

His contributions to cryptogamic botany are recognized by

scientists at home and abroad as standard works of great value. The particular field of his investigations had previously been but little worked, but his labors have stimulated research in these very attractive by-paths of science. He will long be remembered by those who were his friends and correspondents, for his kindliness of heart, as well as for his conscientious care in the department of science to which he devoted the energies of his later years.

C. H. KAIN.

A Simple Point in Nomenclature.

In these later days it may be said that the "air is filled" with discussions on this perplexing subject, and we have all sorts of suggested reforms looking toward the ultimate stability of our plant-names. The Committee appointed by the American Association will undoubtedly give us a valuable set of working rules at the approaching Madison meeting, but while they are concerning themselves with the weightier problems, I take the liberty of calling to their attention a very small point upon which it would perhaps be well to have an authoritative ruling. This question is: When it is desired to question either of the members of a plant-name, where shall the question mark be placed? This seems a very trivial question, but, judging from the variation in its use, it is not properly appreciated.

Suppose for example that a botanist is working up a collection of plants and finds one which seems to be *Ranunculus aquatilis*, L., but the material is not sufficient to be positive. In a printed enumeration how will this doubt be expressed? The following forms [given as models] have all been abundantly observed: ? *Ranunculus aquatilis*, L.; *Ranunculus* ? *aquatilis*, L.; *Ranunculus aquatilis*? L.; *Ranunculus aquatilis*, L.?, with the further variation of placing them all in brackets.

If, as is ordinarily understood, the interrogation mark questions the word which it follows, we shall clearly have a state of affairs not only contradictory but not contemplated in many cases. In a great majority of instances it is probable that the intention is to question the species, but such indiscriminate use of the question mark can only lead to confusion, when it is remembered that there are at least three separate and distinct things which it is some-

times desirable to question. These are the genus, the species, and the authority. If it was always understood that the mark cast doubt upon the word which it immediately followed, it could be used with an exactness which it does not now admit of. Is it not worth while for the committee to formulate a rule which will embody the above facts? F. H. KNOWLTON.

U. S. NATIONAL MUSEUM, March 25, 1893.

[It would seem that the interrogation mark placed as in the first and fourth of Mr. Sudworth's models should indicate that the author is in doubt whether he is or is not referring to the *Ranunculus aquatilis* of Linnæus; placed as in the second model would indicate that doubt is thrown on *Ranunculus aquatilis* belonging in the genus *Ranunculus*, and would ordinarily only be employed in the first description of a plant. We see no particular application for the third method.—ED.]

Further Notes on American Species of Polygonum.

BY JOHN K. SMALL.

(PLATE CLVI.)

Since the publication of my Preliminary List of American Species of *Polygonum* in the BULLETIN of December, 1892, I have had an opportunity to examine and study, among other collections, those of the Geological and Natural History Survey of Canada and the California Academy of Sciences. The former is rich in specimens from the territory north of the United States, and the latter is remarkably well stocked with rare and interesting Western material, as well as some of the very scarce species from the Andes of South America.

The following notes and descriptions of new forms are the result of some observations on the different species recorded below. I also take occasion in this place to ask collectors, in whatever part of the country they may be, to gather all the forms of the genus under consideration that they may meet with during the coming season.

POLYGONUM SAWATCHENSE, n. sp. Annual; more or less scurfy or papillose throughout, of a dull green color; stem erect, striate, obscurely four-angled and four-winged below the ocreæ,

branched from the base, .6–1.5 dm. tall; leaves narrowly obovate below, almost linear above, .5–2 cm. long; .1–.4 cm. broad, sessile, with conspicuous articulations at the junctions with the ocreæ, acute at the apex, acuminate at the base, strongly revolute, much the same length even to the summit of the stem; mid-rib very prominent beneath and generally wing-like; ocreæ funnel-form, lacerate to about the middle; inflorescence of axillary clusters extending to the very base of the stem, and bearing from one to four flowers; flowers rather large; calyx five-parted, green, only slightly lighter on the borders; style very short, three-parted, the divisions hardly perceptible; achene triquetrous, oblong, rather blunt at both ends, smooth and very glossy.

A well marked species of the Avicularia section collected by Brandegee on the Sawatch Range, Colorado. The specimens are in the Herbarium of the California Academy of Sciences.

POLYGONUM PUNCTATUM, Ell., var. ECILIATUM, n. var. More robust than the species, less scurfy throughout, erect, much branched; leaves lanceolate to oblong-lanceolate, rather broad, less punctate than the normal form; ocreæ cylindric, loose, long, strictly entire and free from bristles; the narrow racemes, as well as the upper parts of the pedicels, dark reddish-purple; achene broadly oblong, finely but plainly reticulated.

Differs from the species principally in its glossy appearance, owing to the absence of the usual scurfy surface, perfectly smooth and eciliate ocreæ, and the slightly narrower and more reticulated achene. The color of the flowers and racemes, though of less consequence, is very striking.

Collected by Mr. Pringle in wet places, Valley of Toluca in the State of Mexico. No. 4213.

POLYGONUM PERSICARIOIDES, H. B. K. This sub-tropical species heretofore so imperfectly known, has been discovered in Lower California, by Mr. Brandegee, at two localities, namely, San Jose del Cabo and Sierra de San Francisquito. It ought to be found in Southern California and the States to the east.

Mr. Pringle, in his last Mexican journey, encountered a peculiar form of this species. The stems are several from an oblique root-stalk, simple or nearly so, leaves shorter, broader and less acute than in the normal form, and the narrow racemes fewer flowered. The habitat is given as wet meadows, Valley of Toluca, State of Mexico, No. 4218.

POLYGONUM HYDROPIPEROIDES, Michx., var. STRIGOSUM, Small. Very common in slow streams, swamps, etc., in the San Bernardino Valley, California, according to Mr. S. B. Parish, who has collected fine specimens and records its flowering season as October and November. Mr. J. W. Congdon has also gathered it at Visalia, Tulare county, California, which is some distance north of the San Bernardino Valley. The variety holds its character in every respect.

As we have it now from different points east of the Mississippi River and from two localities near the Pacific coast, we may expect it to be found in the future at intermediate places.

P. hydropiperoides, as well as the variety *strigosum*, has an almost invariable character which, it seems, has never been recorded. The stem or branches always produce, at the distance of three-fourths of an inch or less above the angle of branching, a node with a leaf and ocrea, thus making an internode several times shorter than normal length.

POLYGONUM LITTORALE, Link. Although this species has found no place in the text-books or other botanies of our country it is not uncommon. Usually, it has been confounded with either *P. erectum* or *P. aviculare*, neither of which it resembles so closely as to render such a confusion excusable. The examination of material, in different herbaria, under the above mentioned names will doubtless show that the species is not rare. I find a number of botanists, feeling that no allowence was made for this form, have left it unnamed in their collections. *P. littorale* is more woody than *P. erectum* and *P. aviculare*. It spreads out extensively, one plant often covering several square yards. Its achene is much broader and less pointed, and also of a darker color (almost black), less reticulated and more shining than that of *P. aviculare*. Specimens in the Herbarium of the Geological Survey of Canada give us a considerable Northern extension of the range, Macoun having found it in British America at Silver City, on the Rocky Mountains, and on open praries near Walsh, N. W. T.

POLYGONUM RAYI, Babington. For the present we will have to consider this as an introduced and naturalized plant. But as it is appearing from so many and widely separated localities it may yet prove to be native. It grows plentifully on the coasts of Europe

in company with *P. maritimum*, with which it has always been confounded here. *P. maritimum* is common to both Europe and America, and there is no reason why *P. Rayi* should not be also. It is true that this species is closely related to *P. maritimum*, but it can readily be distinguished by the more acute achene which protrudes farther beyond the calyx, by the longer internodes, the flat and fewer veined leaves, and the few veined ocreæ. The whole plant is also less glaucous. We now have it well represented in British America, as the following stations will indicate: sea beaches, Brackley Point, Prince Edward Island (Macoun); sandy beaches, Bass River, N. B. (Fowler); Jupiter River, Anticosti, P. Q. (Macoun). The most interesting locality is Qualicum, Vancouver Island (Macoun).

POLYGONUM AUSTINÆ, Greene. The range of this once obscure species is gradually being brought to light. Some time after its discovery on the sage-brush plains in Northern California by Mrs. Austin, the plant was picked up by the U. S. Geological Surveys in the Yellowstone Park, Wyoming. This specimen found its way to the National Herbarium at Washington and remained there undetermined. I now find that the species was discovered in British America by Dawson at South Kootanie Pass, on the Rocky Mountains, one year previous to its collection in California. This specimen is preserved in the Herbarium of the Geological Survey of Canada, having been erroneously determined as *P. tenue*, var. *latifolium*. *P. Austinæ* is a remarkably clear species, holding the characters given to it originally by Prof. Greene (Bull. Cal. Acad. Sci. i. 212), with one minor exception. I find that often the achene at maturity slightly surpasses the calyx.

POLYGONUM KELLOGGII, Greene. Before my preliminary paper on the genus was printed I had not seen Prof. Greene's type nor a specimen of what he referred to his new species. Being thus unable to tell exactly what he included under *P. Kelloggii*, I temporarily placed all forms related to *P. imbricatum* under that species. As I have lately become fully acquainted with this plant I can now map out the following geographical range for it—Washington; Shamania County (Suksdorf): California; Modoc county (Mrs. Austin), Lake County, Snow mountains (Brandegee), Donner Lake, Mariposa County, Yosemite

(Bolander), Placer County (Carpenter): Utah; Parley's Park, 6500 ft. (Watson, 1062 in part), Alta Wahsatch mountains 10,000 ft. (Jones, 1105): Colorado: Bear Creek valley, near Empire, 10,000 ft. (Patterson).

Thomas Hogg.

Mr. Thomas Hogg, an active and highly esteemed member of the Torrey Botanical Club, died suddenly of angina pectoris, on the 30th of December, 1892. He was born in London, February 6, 1820, and came to this country with his father, Thomas Hogg, Senior, when only 9 months old. From his earliest years his natural taste for the study of plants and horticultural pursuits was fostered by his surroundings. His father was long engaged in the management of gardens and greenhouse culture before leaving England, and was all his life afterwards a successful nurseryman and florist in the city of New York. In this business he was assisted by Thomas Hogg, Junior, and his brother James, who took charge of his establishment at his death in 1855, and for many years subsequently conducted the business on their own account.

Mr. Hogg was made United States Marshal in the year 1862, and in that capacity paid a visit to Japan, in which country he remained eight years. At the end of that period he resigned his office and returned home. Shortly after, however, he was invited by the Japanese Government to return to the Island and take office in the Custom House, which he did, spending two years more in that service. During his long sojourn in Japan, he spent much time in travelling over the Islands and studying their flora, his official position giving him unusual facilities for exploration and collection. He made a large collection of Japanese trees, shrubs and herbaceous plants, such as he thought adapted to culture in our country. These he shipped to New York, many of them subsequently finding their way to England. Among those which proved to be adapted to our climate, are many of the choicest Japanese plants which ornament our gardens to-day, which he was the first to introduce.

In this manner Mr. Hogg acquired that familiarity with horticulture for which he was noted, and about which his advice was

often sought. He was a diligent reader of horticultural publications, and frequently contributed articles of interest to our garden periodicals, keeping almost to the last day of his life well informed as to all the movements in floriculture in all parts of the world.

After withdrawing from business, Mr. Hogg led a retired life, but lost none of his love for his favorite studies, for his leisure was spent in botanical and other scientific investigations. Much of his time was spent in visiting various libraries and florists' establishments in this city, and on several occasions he went abroad and visited the most celebrated botanical gardens in Europe. His last years were much broken by ill health caused by an attack of the influenza in Paris some two years since, from the effects of which he never fully recovered.

In manner Mr. Hogg was grave, dignified and reserved, but he was invariably cheerful, and genial and kindly in spirit. Among congenial companions his conversation was sprightly, and often strikingly original and interesting, but his modesty was so great that few except such companions ever learned how rich were his stores of knowledge, not only upon his favorite subjects, but also upon a wide range of other topics. His conversation sparkled with humorous anecdotes and shrewd observations upon the various people and scenes which he had encountered in the course of his long life.

Mr. Hogg was admitted to membership in the Torrey Botanical Club in 1882. In 1886 he was elected Vice President of the Club, and chosen annually to the same office until the time of his death, except during the year 1891, when he was absent in Europe. He was seldom absent from the meetings when at home, and frequently participated actively in the proceedings and discussions, greatly contributing to the interest of the occasion by his pertinent and entertaining remarks. THOMAS MORONG.

Death of Dr. George Vasey.

Dr. George Vasey, Botanist of the United States Department of Agriculture and Honorary Curator of the National Herbarium, died at his home in Washington, March 4, 1893, after an illness of only a few days duration, of acute peritonitis. He had been absent from his office but four days, and the news of his death

came with almost equal suddenness to those at a distance from Washington and those intimately associated with him in his work.

At the request of Dr. Vasey's family, his friend Mr. William M. Canby has undertaken the preparation of a biographical memoir, to contain a more extended account of Dr. Vasey's life, work, and publications; and to him have been intrusted the data requisite for its compilation. It is necessary here, therefore, to give only an outline of his career.

George Vasey was born near Scarborough, England, February 28, 1822, of English parents; and in the following year was brought by them to America. His boyhood was spent in Central New York, where from his acquaintance with Dr. P. D. Knieskern, of Oriskany, he became interested at the early age of sixteen years in the study of the local flora. In 1847 he received the degree of Doctor of Medicine at Pittsfield, Massachusetts, and from 1848 to 1868 was engaged in the practice of his profession, residing during the principal part of that period in Northern Illinois.

As this point in Dr. Vasey's life his botanical knowledge, which had previously been held subsidiary to his profession of medicine, took upon itself a new character. In 1868 he accompanied Major J. W. Powell, in the position of botanist, on an exploring expedition to Colorado. A second similar expedition to the same region followed during the next year; in 1870 he was placed in charge of the Museum of the Illinois Natural History Society at Bloomington; and in 1872 he was called to Washington as Botanist of the United States Department of Agriculture. From this time until his death his efforts were devoted earnestly and unremittingly to his work, new as a profession, but old as a cherished pursuit.

The age of fifty seems late for the beginning of a scientific career. Up to that time Dr. Vasey had published only a few unimportant notes, but his preparation had been long, faithful, and opportune. He now began to publish papers one by one, at first on the subject of trees, afterward principally devoted to the Gramineæ. His activity seemed to increase with his age, and during the last year of his life he probably produced more matter for publication than during any earlier period of equal length. The second part of the "Grasses of the Pacific Slope" was already in the printer's hands at the time of his death, and the manuscript

for the concluding brochure of his "Monograph of the Grasses of the United States" was so near completion that it can be edited according to its author's plan.

Dr. Vasey's principal publications are too well known to require comment here, but we cannot omit a reference to the greatest and most lasting monument to his memory, the National Herbarium. To building up this great collection he devoted his most faithful energies, and the future student of American botany will give him well deserved honor for this bounteous legacy.

FREDERICK VERNON COVILLE.

Reviews of Foreign Literature.

Les Maladies Cryptogamiques des Cereales. Par J. Loverdo, Paris, 1892. This work of 300 pages and 35 figures, treats of the fungi parasitic upon wheat, rye, maize, barley, oats, sorghum, millet, rice and buckwheat, and under each species, the enemy, in the order of history, exterior characters, botanical aspect, condition of development, effect of the disease, and means of defense. Under bacteria, *Bacillus Sorghi*, Burl., is treated at length with figures after Kellerman. The Ustilagineæ are largely considered on pages 40 to 145, ten of the *Ustilagos* proper receiving treatment, three *Tiletias* and *Urocystis occulta*. The chapter upon the penetration of the ustilago germ is an interesting review of the modern view established by DeBary, Brefeld and others with its important economic bearings. Less space is given to the Uredineæ than the smuts, only *Puccinia graminis*, *P. rubigo-vera*, *P. coronata*, *P. Sorghi* and *P. purpurea* being given in particular. The figures are not of the best, those after DeBary and Cavara being much better than those d'apres nature. The Ascomycetes brought to the front are *Erysiphe graminis*, *Sphærella exitralis*, and, of course, the Ergot (*Claviceps purpurea*), over thirty pages being given to this with several of Tulasne's cuts. A few pages are devoted to the imperfect forms of *Helminthosporiums* and *Septorias*. The practical vegetable pathologist can find in this work much to interest him at very small expense. B. D. H.

On the Genus Myeloxylon, Brong. A. C Seward. (Ann. Bot. vii. 1–20. Pl. 1, 2.) The author gives the results obtained from a

microscopic examination of specimens of *Myeloxylon* from the Millstone Grit of the British Carboniferous. Similar or identical wood from other localities have been classed at different times as a palm, a fern and a cycad and have been described under the generic names *Palmacites*, *Myelopteris*, *Medullosa*, *Stenzelia*. The author's conclusions are that the true position of *Myeloxylon* is intermediate between the ferns and cycads, but most closely allied to the latter. A. H.

Proceedings of the Club.

TUESDAY EVENING, APRIL 11TH, 1893.

Vice-President Morong in the chair and 27 persons present.

The following members were appointed to serve as the Field Committee for the season of 1893:

Dr. Thos. Morong, Mr. Henry Kraemer, Rev. Geo. D. Hulst, Dr. Jeannette B. Greene, Miss L. R. Heller.

Dr. H. H. Rusby and Dr. Thos. Morong were appointed delegates to the Council of the Scientific Alliance of New York for the year May, 1893—May, 1894, to serve with the President of the Club.

The following persons were elected Active Members:

Miss Susan Travers, Riverdale, New York City; Mr. Samuel Henshaw, West Brighton, Staten Island, New York; Mr. Henry A. Siebrecht, New Rochelle, New York; Prof. Fred. W. Seringhaus, 954 Eighth Ave., New York City.

The following papers were then presented.

By Prof. Byron D. Halsted, "Some Results with Fungicides," illustrated by lantern slides.

By Mr. John K. Small "Further Notes on American Species of *Polygonum*," illustrated by specimens. The paper is published in this number of the BULLETIN.

By Mr. A. A. Heller, "The United States Department of Agriculture Expedition to Idaho in 1892," illustrated by specimens and a map.

Dr. Thos. C. Porter described his collection of the Grasses of Pennsylvania, made for the Pennsylvania State Agricultural Society, for exhibition at the World's Columbian Exhibition at Chicago. A list of these Grasses, giving their distribution in the State is printed in this number of the BULLETIN.

Dr. Britton exhibited a specimen of the base of a Horse Chestnut tree, *Æsculus Hippocastanum*, obtained by Mr. Walter C. Kerr at Tompkinsville, Staten Island, and first described at a recent meeting of the Natural Science Association of Staten Island. The specimen showed a remarkable development of adventitious buds arising from the cambium, the wood having almost entirely decayed away. There are more than 100 of these buds on the specimen which is about one foot high and ten inches wide. The length of some of the shoots indicates that these buds have been forming for at least two years.

Dr. Britton announced the death in Geneva, Switzerland, of M. Alphonse DeCandolle, an Honorary Member of the Club, and one of the most eminent botanists of the century. He alluded to M. DeCandolle's invaluable scientific work and moved the appointment of a committee to draw up a suitable minute for record in the proceedings of the Club and for transmission to his son, M. Casimir DeCandolle. The motion was seconded and carried. The Chairman appointed Dr. Britton and Dr. Rusby as such Committee.

Dr. Morong distributed copies of the circular of the Instruction Committee, giving the programme for the summer course in Botany carried on by the Committee in coöperation with the College of Pharmacy of the City of New York.

Tuesday Evening, April 25th, 1893.

Vice-President Morong in the chair and 43 persons present.

The meeting was held on this evening instead of the following in order to give members of the Club opportunity to participate in the ceremonies attending the unveiling of the monument to John James Audubon, at the American Museum of Natural History, which were conducted on Wednesday evening, April 26.

Dr. Morong presented a report for the committee appointed to prepare a statement regarding the death of Mr. Thos. Hogg. This statement will be found upon another page of the Bulletin.

Mr. Cornelius Van Brunt presented the announced paper of the evening on "Botany and Photography." The paper reported the result of an extended series of experiments in photographing plants in flower, and was illustrated by a large number of lantern

slides, from which it was evident that the experiments had been highly successful. Many of the slides had been colored by Mrs. Van Brunt, and the accuracy and delicacy of the coloring was much admired.

Index to Recent Literature Relating to American Botany.

Acaroecidien und Acarodomatien—Einige neue. G. de Lagerheirm (Ber. Deutsch. Bot. Gesell. x. 611–619).

Bacteria in the Dairy. H. W. Conn (5th Ann. Rep. Storrs School Agric. Exp. Sta. 106–126).

Cæsalpinia—The Genus. E. M. Fisher (Bot. Gaz. xviii. 121–123).

Mr. Fisher has followed up the suggestion made in the BULLETIN, vol. xix. p. 345, that the species of *Hoffmanseggia*, so critically described by him (Contr. Nat. Herb. i. No. 5), should be referred to *Cæsalpinia*, and now transfers them all to this genus.

Contributions to the Life Histories of Plants. No. VIII. Thomas Meehan (Proc. Acad. Nat. Sci. Phila. 1892, 366–386).

This paper consists of observations on the following subjects: *Euphrasia officinalis;* Notes on *Gaura* and *Œnothera:* The Carpellary Structure of *Nymphæa;* On the Sexual Characters of *Rhus; Rubus Chamæmorus; Dalibarda repens*; On some Morphological Distinctions in the Genera of Ericaceæ; Vitality of Seeds, *Lysimachia atropurpurea; Campanula rotundifolia; Cornus Canadensis; Aralia hispida; Luzula campestris; Cakile Americana; Hypericum ellipticum; Trifolium hybridum; Lathyrus maritimus; Lonicera cærulea; Raphanus sativus;* On the Nature of the Verrucæ in some Convolvulaceæ; *Polygonum cilinode; Aster Tatarica.*

Contributions to Western Botany, No. 3. Marcus E. Jones (Zoe. iii. 283–309).

Notes on a large number the species, the following described as new: *Lepidium heterophyllum; Astragalus diphysus*, var. *latus; A. Beckwithii*, var. *purpureus; A. Dodgianus; A. Ibapensis; A. Peabodianus; A. Toanus; A. atratus*, var. *stenophyllus; Cymopterus Ibapensis*, and *Primula Broadheadæ.*

Diatomaceæ of Minnesota, Inter-Glacial Peat. Benj. W. Thomas (Geol. and Nat. Hist. Surv. Minn. Twentieth Ann. Rept. (1891), 290–320).

The discovery of diatoms in a peat bed, in Blue Earth county, Minn., interbedded between glacial clays, is described and about 100 species are listed. They are all fresh water, and with few exceptions, living species. The clays above and below the peat are of marine origin. The list is the work of H. L. Smith, and accompanying it are a series of critical notes, which are of great value for reference and comparison. A chapter upon methods of preparation, by Dr. C. Johnston, is also appended. A. H.

Fungi common in 1892 in Iowa. L. H. Pammel (Agric. Sci. January, 1893).

A long list arranged under the several orders of the most destructive fungi of last year in Central Iowa.

Fungus—A Parasitic (Heterosporium asperatum). Geo. Massee (Am. Jour. Mic. February, 1893).

This treats of the *Heterosporium* as parasitic upon *Smilacina stellata*, accompanied by a full page plate, giving details of the structure of the fungus.

Grasses—Some Diseases of. W. C. Stevens (Kan. Univ. Quart. January, 1893).

The grass fungus parasites with regard to their effects are grouped: (1) as those destructive to host tissues, *Puccinias* as examples; (2) those producing abnormal growths, corn smut as illustration; (3) destroying the chlorophyll, and (4) those attacking the ovaries, as the ergots. Three microphotograph plates illustrate the points made.

Leguminosengattungen—Zur Kenntniss einige. P. Taubert (Ber. Deutsch. Bot. Gesell. x. 637–642).

The genus *Garugandra*, Griseb, found on a tree of the Argentine Republic and Bolivia, is referred to *Gleditschia* and figured.

Myxomycetes of the Miami Valley. A. P. Morgan (Jour. Cincinnati Soc. Nat. Hist. xv., Nos. 3–4).

This is the first of a series of papers; characterizes the group; lists the species with descriptions under two orders, namely: Li-

ceaceæ and Reticulariaceæ and records five new species with figures of them in a single plate.

Phalloid—A New. A. P. Morgan (Jour. Cincinnati Soc. Nat. Hist. xv., Nos. 3 and 4). *Phallogaster* as a new genus is described and under it *Phallogaster saccatus*, Morgan, n. sp. A full page plate is given of the same.

Phyllogaster saccatus—Note on. Roland Thaxter (Bot. Gaz. xviii. 117–121, one plate).

Revision der Kleineren Ranunculaceen-Gattungen Myosurus, Trautvetteria, Hamadryas, Glaucidium, Hydrastis, Eranthis, Coptis, Anemonopsis, Actæa, Cimicifuga and Xanthorrhiza.—E. Huth (Engler's Bot. Jahrb. xvi. 278–324).

For a critical review of this important paper, we would refer to Prof. Greene in Erythea, i. 70.

Root Tubercles of Indigenous and exotic Legumes in Virgin Soil of Northwest. H. L. Bolley (Agric. Sci. February, 1893).

Twenty-one native species of Leguminosæ are named as bearing tubercles, the character of the soil, usually in Dakota, being given for each host. In like manner sixteen exotic species of the same order are listed as bearing the tubercles. Non-leguminous plants as *Alnus, Shepherdia* and *Eleagnus* are mentioned as bearing nodules upon their roots.

Russian Thistle and other Troublesome Weeds in the Wheat Region of Minnesota and South Dakota. L. H. Dewey (U. S. Dept. Agric., Farmer's Bulletin No. 10 pp. 16, two plates).

The "Russian Thistle" or "Russian Cactus" is *Salsola Kali*, L., var. *Tragus*, D. C., closely related to the saltwort of the sea-beaches, and thus neither a thistle nor a cactus. It has long been a pernicious weed in the wheat regions of Russia and became introduced into those of our Northwest about fifteen years ago. It has now spread over some 30,000 square miles and is the cause of much financial loss and endless trouble.

Salix balsamifera. Edward L. Rand (Garden and Forest, vi. 105).

Schneeflora des Pichincha. Ein Beitrag zur Kenntniss der Nivalen Algen und Pilze. G. de Lagerheim (Ber. Deutsch. Bot. Gesell. x. 517–534, one plate).

Description of new species in the genera *Chlamydomonas*, *Raphidonema*, and of a new genus, *Selenotilla*, with a list other plants of low organization from the snows of this Equador mountain peak.

Sereno Watson. George Lincoln Goodale (Proc. Amer. Acad. Arts and Sci. xxvii. 403–416).

A biographical notice with portrait and a list of Dr. Watson's published papers.

Slime-molds and Club-root. A. B. Seymour (American Gardening, xiv. 160).

Some Bean Diseases. S. A. Beach (A thesis in the Botanical Department of Iowa Agric. College for the master's degree).

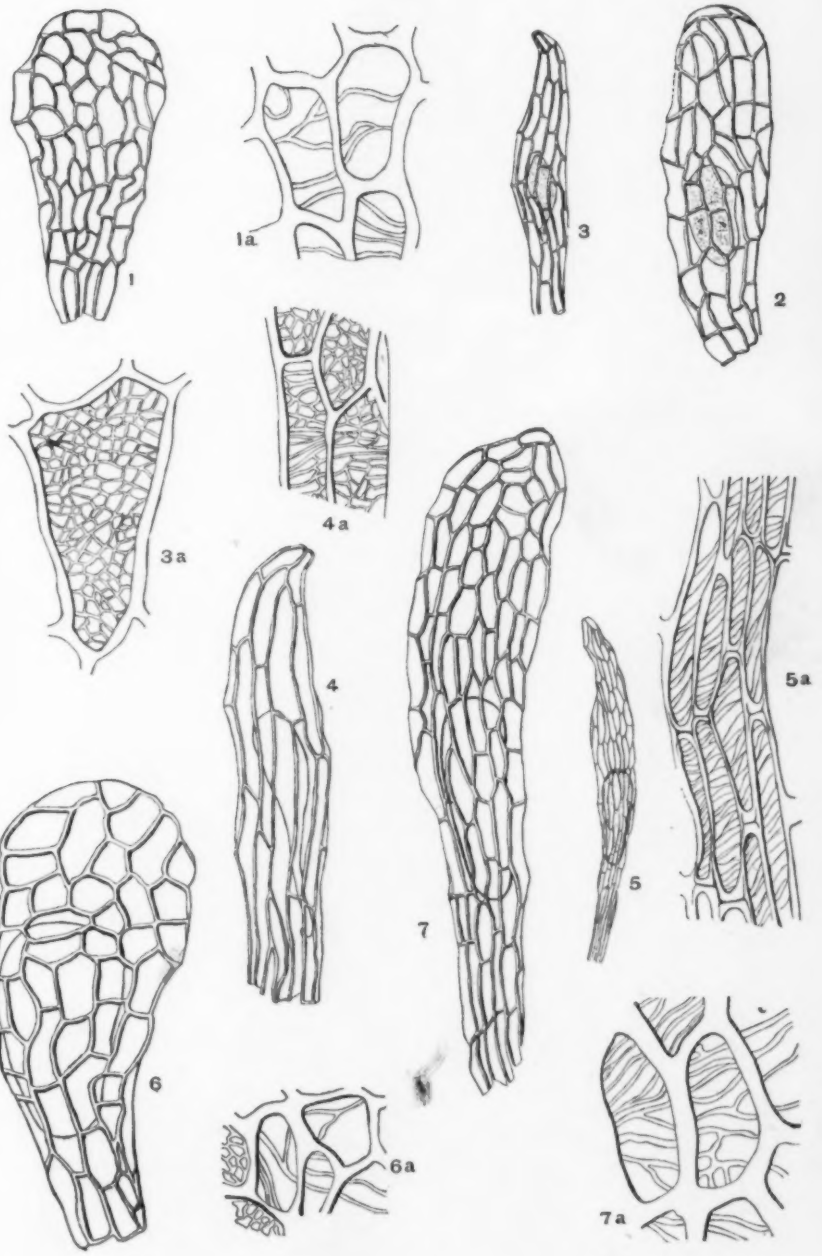
This is an extensive paper upon the Bean Pod Spot (*Colletotrichum Lindemuthianum* (S. & M.) B. & C)., giving the distribution and character of the disease and its appearance upon pods, leaves, seed and seedlings. Field experiments were made with fungicides, and comparisons of results are given in the chapter closing with a bibliography of the subject.

Brief mention is added of a bacterial bean blight and of the Bean Rust (*Uromyces Phaseoli* (Pers.) Wint). Six full page plates are given. The same matter appears as Bull. 48 of the Geneva, N. Y., Exp. Station pp. 305–333. B. D. H.

Stuartia.—Geo. Nicholson (Garden, xliii. 172). With a figure of *Stuartia Virginica.*

The New Botany. Lester F. Ward (Science, xxi. 43, 44).

This article is in the nature of a plea for the more systematic study of plant affinities rather than plant differences. The author urges the necessity for the study of fossil plants in order that we may understand the ancestry of our living plants and how these came to be what we now find them. The mere determination of plants, either living or fossil, is of course necessary, but in order to appreciate fully what these determinations mean, a close study of their affinities is necessary, and this can only be done by a close comparison of living and fossil forms. A. H.



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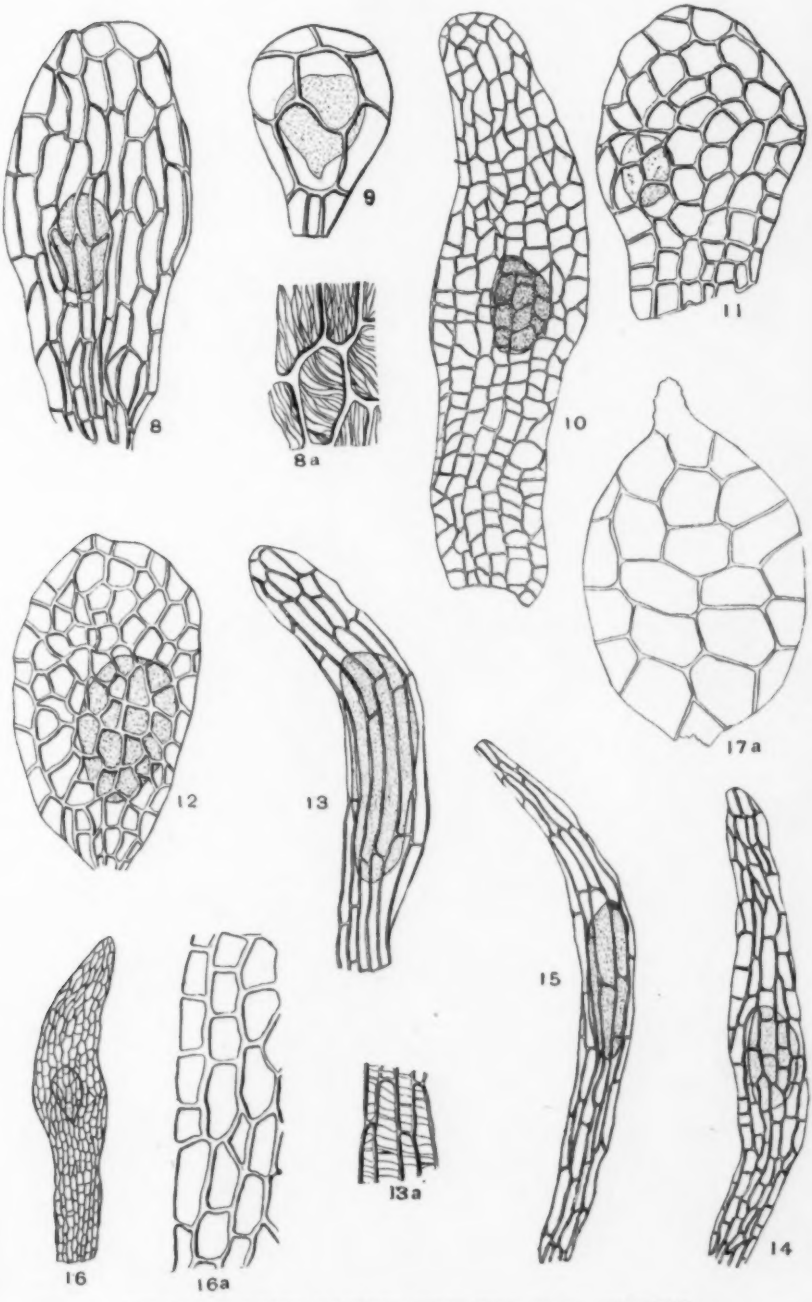

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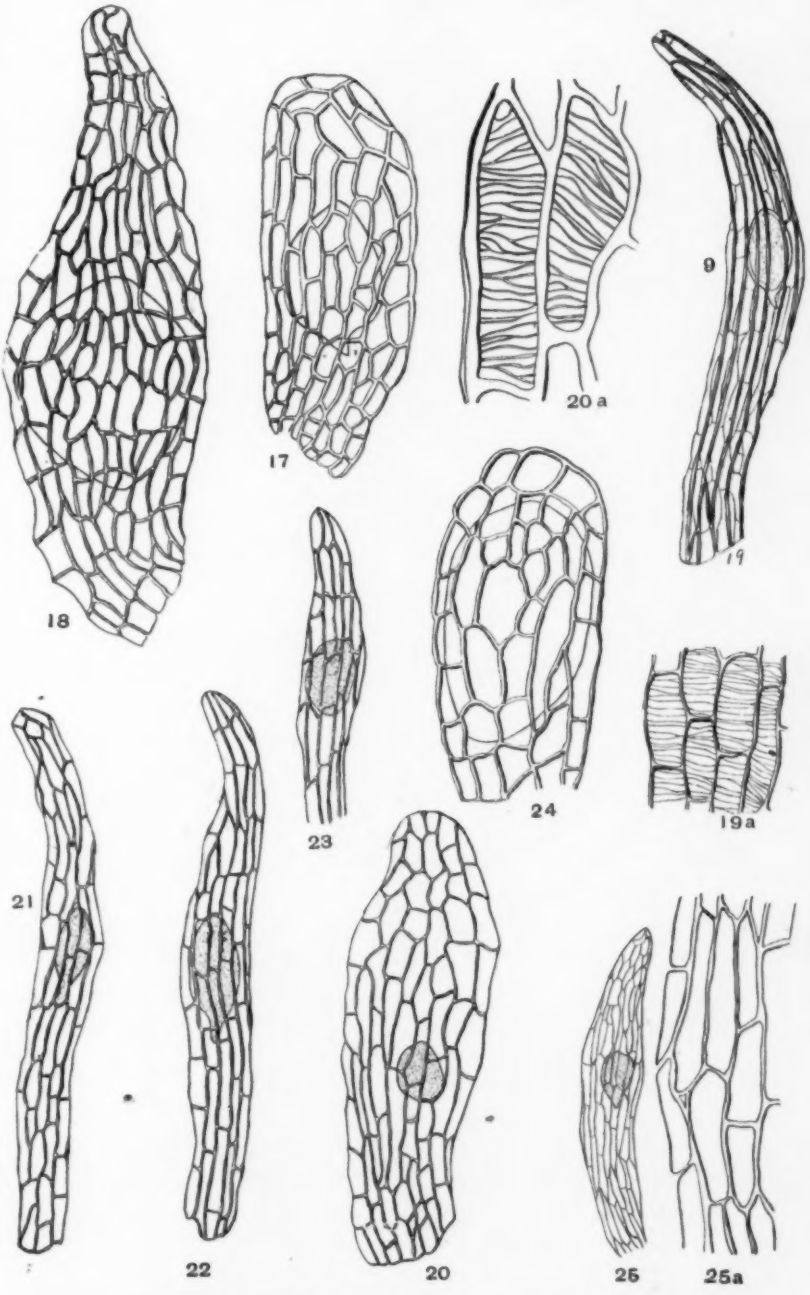

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